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ABSTRACT

This research compared two methods used to investigate the knowledge of internal body parts by children ages 4 to 9 years. Subjects were 50 Italian children: 18 preschoolers, 21 first graders, and 11 second or third graders. Children performed two tasks, a Drawing Task in which they drew on the outline of a human figure all the body parts they could recall and named them; and a Recognition Task in which children selected among three pictures of the inside of the human body and named all the body parts they could recognize. Children's performance was scored by counting the number of body parts drawn and labeled, with paired structures counted as a single response in both tasks. Results indicated that the Recognition Task elicited a greater number of body parts than the Drawing Task. Older children performed better than younger ones on both tasks, and boys did better than girls on both tasks. The most commonly listed body parts were heart, brain, bones, blood, and muscles. (Contains 21 references.) (Author/KDFB)

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What Do Children Know about the Interior of the Body? A Comparison of Two Methods of Investigation

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Abstract

This research investigated the relationship of two methods used to investigate the knowledge of internal body parts for children aged 4 to 9 years. Subjects were 50 Italian children, 18 preschoolers, 21 first graders and 11 2nd/3rd graders.
Children performed two tasks, a Drawing Task where each child was requested to draw on a human figure outline all the body parts he/she could recall and to name them; And a Recognition Task where each child was to choose among three pictures of the inside of the human body and to name all the body parts he/she could recognize.
Children's performances were scored by counting the number of body parts drawn and labeled (simple frequencies) with paired structures counted as a single response in the Drawing Task and in the Recognition Task.
Results showed that the Recognition Task was able to elicit quite a greater number of body parts than the Drawing Task. And as it was expected older children performed better than younger ones in both Tasks. While, contrary to what was expected the findings revealed sex differences among the sample. Boys did better than girls on both Drawing Task and Recognition Task.
The most commonly listed body parts were heart, brain, bones, blood, and muscles
Results will help medics to meet children's needs for information and support in health care settings so that communication can take place at an appropriate level.
Implications on applying the Recognition Task as a friendly method in assessing young children's knowledge of the inside of the body and directions for future research are discussed.

Introduction

To support and inform children in health care settings, it is necessary for medics to know what they understand of the body's interior, so that communication can take place at an appropriate level.

Children's ability to identify what organs are "inside the body," as well as what these organs do, increases with age and developmental stage. Young children have very limited knowledge about internal anatomy and may have misconceptions about the location of those internal body parts they do know about (e.g. Gellert, 1962; Porter, 1974; Crider, 1981; Pawletko et al., 1995; for a review see Jones, Badger and Moore, 1992).

A number of researchers have argued that children's beliefs about the inside of the body progress systematically through a series of stages paralleling the shift

from preoperational to formal operational thought described by Piaget (1929). From this perspective, it is generally agreed (Crider, 1981; Glaun and Rosenthal, 1987) that the preoperational child of approximately 5-6 years perceives the body in a global and undifferentiated manner, confusing internal and external parts. The concrete operational child of around 9-10 years of age knows more body parts and importantly begins to integrate or connect parts. But is not until adolescent and formal operational thinking that there is an understanding of levels of body organisation into systems.

But labelling the phases in children's conceptions of the body interior as preoperational, concrete operational, and formal operational is to claim that there is something about the nature of children's thought that limits their understanding. Hergenrather and Rabinowitz (1991) argued that applying Piaget's general stages as an explanation of what children know, for example, about the body's interior confuses domain-general inferential abilities with knowledge in specific domains.

Moreover, recent trends in conceptual development have focused attention on how children's concepts are embedded within causal theories about specific domains of knowledge. These trends suggest that even very young children organize their knowledge of the world into commonsense theories (see Wellman and Gelman, 1992, for a review). Yet questions remain as to whether children have theories for particular content areas (e.g. astronomy, religion), and particularly whether they hold a commonsense theory of biology (Carey, 1985; Keil, 1992). Much of the existing literature on children's understanding of biology has focused on concepts of plants and animals. Although these represent highly salient biological entities, the biological principles that underlie features of plants and animals (e.g., genetic transmission) are likely to be unfamiliar to children (Kalish, 1996). Beliefs about the inside of the body, as well as illness and death (as a biological process) represent alternative sub domains.

Moreover, most studies to date have used the same method based on drawing techniques (a recall memory approach) as the Inside-of-the-Body Test (Tait and Asher, 1955) and the Gellert Index of Body Knowledge (Gellert, 1962).

Several studies revealed that some children, especially younger ones, appear to be quite limited in their expression of concepts through the drawing medium (e.g. Ames, 1945; McNamara & Porterfield, 1969). For example, Celotta (1973) found greater competence on a Manikin Construction Task than in drawing in the following ages groups: 3, 5, 7, 9 and 11.

It has also been suggested by Vessey (1988) that young children may know more about their internal bodies if tested with a recognition task, but up to now little research has examined this aspect.

The study

This research compares two methods used to investigate the knowledge of internal body parts for children aged 4 to 9 years: A drawing task with a recognition task. The aim is to examine children's ability (a) to distinguish a correct schematic representation of body's internal organs from two incorrect ones (b) to name organs and describe their functions.

Hypotheses

The study is based on the following hypotheses:

1) Children's knowledge of numbers of body parts will be greater at advanced ages; 2) Children will perform better in the Recognition Task than the Drawing Task; 3) A 'Correct' Picture of bodily anatomy will be chosen most, particularly by older children; 4) Selection of the correct representation of bodily organs will correlate with recognition of more body parts.

Subjects

The sample included 18 preschoolers (mean=5.4, range 4.10 to 6.3), 21 first grade children (mean=6.9, range 6 to 7.3) and 11 2nd and 3rd graders (mean=8.3 range 7.5 to 9.1) from a middle size town in the North of Italy.

All the groups had approximately an equal number of boys and girls.

Measures

In the Drawing Task each child drew on a human figure outline (see Picture 1) all the body parts he/she could recall and to name them. This method is similar to that utilized by several authors investigating children's knowledge of the inside of the body (e.g. Offord and Aponte, 1967; Munari et al. 1976; Brumback, 1977).

The drawings were scored by counting the number of body parts drawn and labeled (simple frequencies) with paired structures counted as a single response.

In the second method, the Recognition Task, the child selected one of three pictures of the inside of the human body as 'the best drawing' and to name all the body parts he/she could recognize.

The three pictures differed in level of correctness:

1) The 'Correct' Picture had all the elements (n=14) drawn correctly in location and in shape (see Picture 2);

2) The 'Fancy' Picture had all the elements drawn (n=14) correctly in location but the shape was stylized (e.g. Valentine's heart ❤, see Picture 3);

3) The 'Wrong' Picture had all the elements drawn (n=14) correct in shape but not in location (see Picture 4).

The 14 body parts represented in the figures were: heart, lungs, stomach, intestine, muscles, bones, brain, blood, liver, veins, bladder, throat, windpipe and oesophagus. Each body parts drawn in the pictures were colored.

Children's performance on this task were scored counting the body parts correctly recognized.

Procedure

Both experimental tasks were administered by the author. Children were chosen randomly among the class. Each child was led from his/her classroom to a small room nearby where s/he was tested individually. A time limit was not given, but all the interviews lasted around 15 minutes and no children did not want to participate or did not finish the interview.

All children were first presented the Drawing Task and then the Recognition Task. In the Drawing Task the experimenter told each child to draw all the body parts he/she could recall and to name them. In the recognition Task children were asked to choose among three pictures of the inside of the human body and to name all the body parts he/she could recognize.

Results

The mean number of body parts drawn by children were similar to that found in previous studies that applied the same method. Preschoolers drew 3.2 parts, 1st graders 3.3 and 2nd/3rd graders 6.4 body parts.

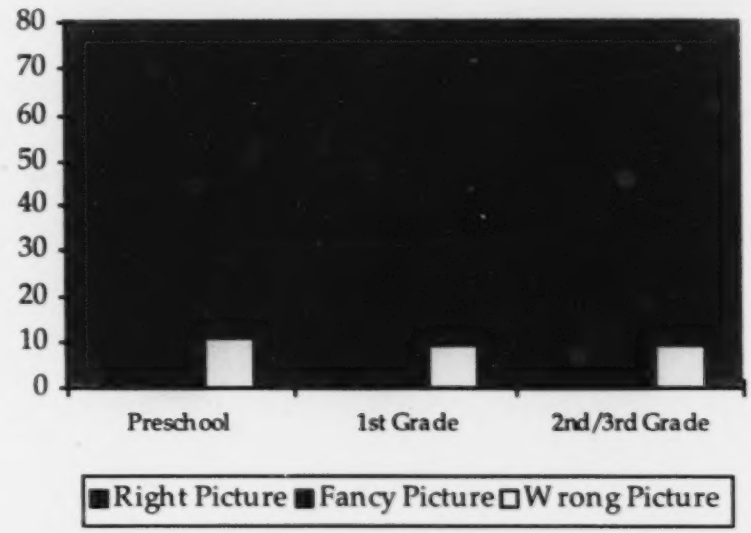
Moreover, a significant difference was found between the mean production on the Recognition Task and on the Drawing Task. For each grade level we obtained a better performance in the Recognition Task. Preschoolers recognized 4.8 body parts ($t(17)= -2.73$, $p< .02$), 1st graders recognized 5.9 parts ($t(20)= -4.08$, $p< .001$), and 2nd/3rd graders recognized 8.6 body parts ($t(20)= -2.23$ $p< .1$). Even though this last group increased his performance it was not significant (see Table 1).

Table 1 - Mean of body parts drawn and recognized by children

	Drawing Task	Recognition Task	T test p
Preschoolers	3.2	4.8	$p< .02$
1st graders	3.3	5.9	$p< .001$
2nd/3rd graders	6.4	8.6	$p< .1$

A frequency analysis revealed that children chose most the Right Picture (52%), second the Fancy Picture 2 (38%) and third the Wrong Picture (10%). If we analyze these results by grade, as we can see from Figure 1, only the first graders prefer most the Fancy Picture (52.4%). Whereas, preschoolers and 2nd-3rd graders still prefer the Right Picture (55.6% and 72.7%). In all the groups the Wrong Picture gets the lowest score.

Figure 1 - Picture chosen by grade



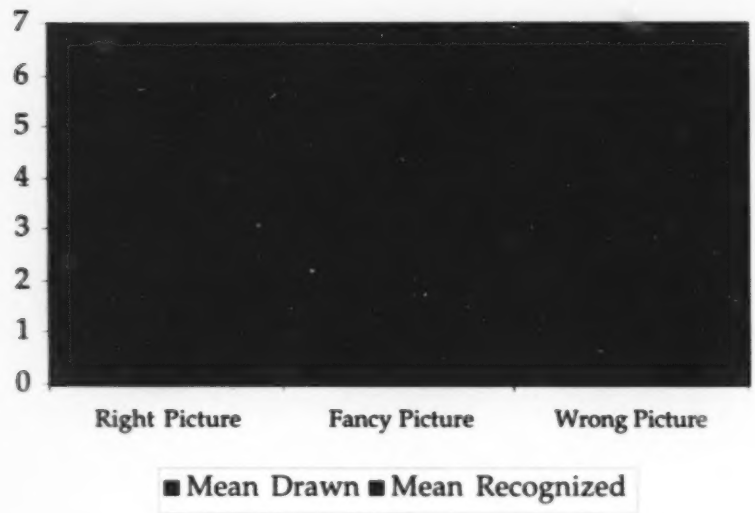
To test the relationship between the Mean of Body Parts Drawn and Recognized with the Picture selected two independent ANOVAs were carried out on the data with the same design: PICTURE SELECTED (CORRECT, FANCY AND WRONG) X AGE (5, 6, 7/8) X SEX (M, F).

The dependent measure for the first analysis was the Mean of Body Parts Drawn. Main effects were obtained for PICTURE ($F(2, 34)= 4.28$, $p< .05$), AGE ($F (2,34)=5.39$, $p<.01$) and SEX ($F(1,34)=6.35$, $p<.02$). No significant interactions were obtained.

Children who chose the Right Picture drew more body parts (mean= 5.12) than who chose the Fancy Picture (mean= 3.11) and the Wrong Picture (mean= 1.4).

Post-hoc analysis (Tukey Test) indicated that only who chose the Wrong Picture significantly differed (alpha 0.05) from those who chose the Correct Picture (see Figure 2).

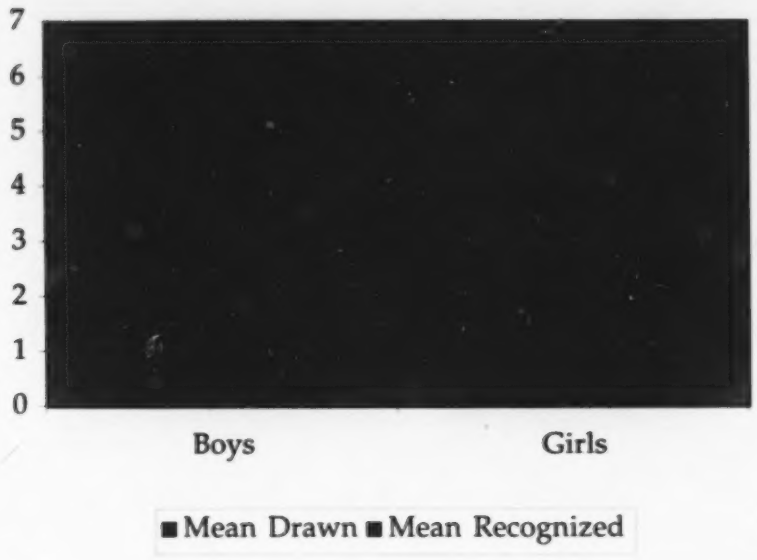
Figure 2 - Mean of body parts drawn and recognized by Picture



Older children drew more body parts (mean= 6.45) than first graders (mean= 3.33) and preschoolers (mean= 3.22) as shown in Table 1. The Tukey Tests indicated that both preschoolers and first grade children significantly differed (alpha 0.05) from 2nd/3rd graders.

The third main effect revealed (see Figure 3) that males performed better (mean= 4.77) than females (mean= 3.12).

Figure 3 - Mean of body parts drawn and recognized by Sex



The second ANOVA considered the Mean of Body Parts Recognized. Again main effects were found for PICTURE ($F(2,34)=13.21$, $p<.001$), AGE ($F(2,34)=9.87$, $p<.001$), and SEX ($F(1,34)=6.44$, $p<.02$). No significant interactions were obtained.

As in the previous ANOVA, children who chose the Correct Picture recognized more body parts (mean= 6.96) than those who chose the Fancy Picture (mean= 6) and the Wrong Picture (mean= 1.6). Tukey tests indicated that children who chose the Wrong Picture significantly differed (alpha 0.05) from those who chose the Correct Picture and the Fancy Picture.

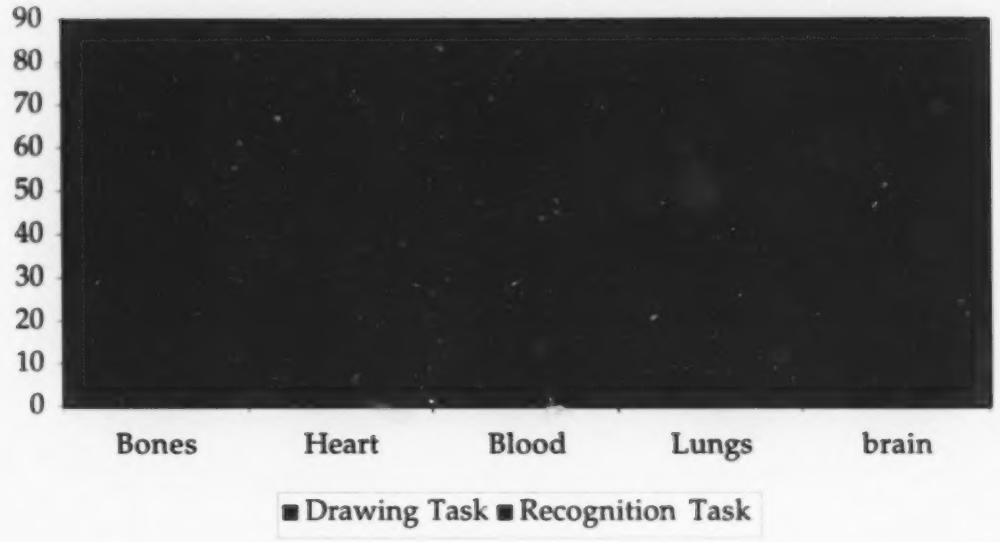
Preschool children (mean= 4.83) were less proficient than first grade children (mean= 5.9) and second/third graders (mean= 8.36) in recognizing body parts (see Table 1). Tukey tests indicated that both preschoolers and first grade children significantly differed (alpha 0.05) from 2nd/3rd graders.

Also in the Recognition Task (see Figure 3) boys performed better (mean= 6.58) than girls (mean= 5.5).

For all ages, the most frequently mentioned items in the Drawing Task were bones (54%), heart (50%), blood (44%), lungs (42%), brain (38%). Whereas, the

same body parts in the Recognition Task obtained respectively: 80%, 82%, 58%, 62%, 74% (see Figure 4).

Figure 4 - The most commonly listed body parts



Discussion

The investigator attempted to show that children can and do express varying levels of knowledge of the human figure depending upon the medium in which they work. The Drawing Task, and similar measures traditionally thought to be adequate reflections of a child's knowledge, is shown to be inferior at all ages to the Recognition Task.

The results show that in using a method different from the one used in previous drawing studies, children know more about their internal bodies than that for which they have been credited. The recognition task was able to elicit quite a wide variety of body parts. This is in sharp contrast to what happened when the preschoolers were asked to draw.

The ability of the Recognition Task to evoke responses from this age level might be taken in account as a device to investigate children's knowledge of the inside

of the body. Moreover children seem to enjoy it, and it is easy to administer and score.

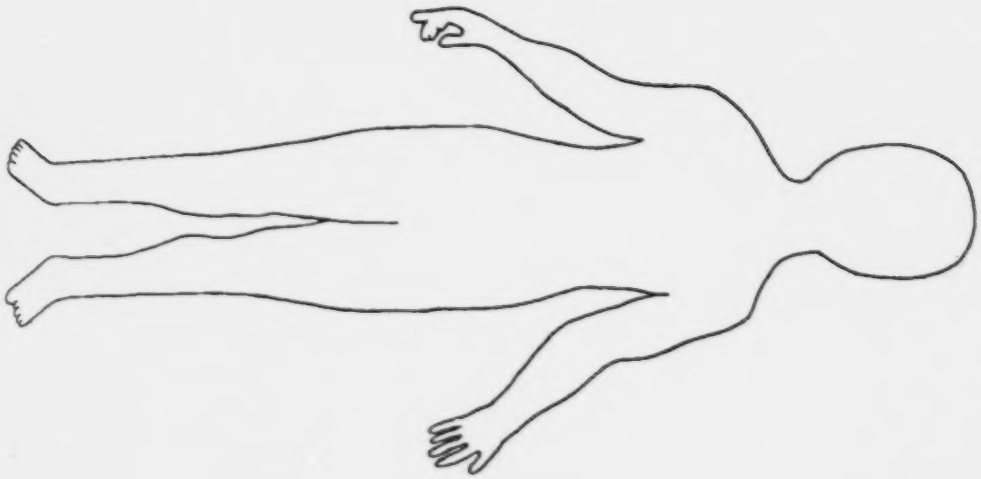
A Recognition Task can also be used to teach children. Vessey (1988), in fact, has demonstrated that children between the ages of $4^1/_2$ and $7^1/_2$ can successfully learn about their internal bodies by either using a life-size rag doll with removable parts or a more traditional approach using flat pictures. Thus, it is important to base teaching children about their internal bodies on empirically methods whenever possible.

The choice among the three kinds of Picture was related to the children's knowledge of the inside of the body. In fact, children who chose the Right Picture were also able to draw and to recognize more body parts compared to children who chose the Fancy Picture or the Wrong Picture.

It is difficult to explain why first grade children, contrary to the other two groups, preferred most the Fancy Picture that represented the inside of the body in fancy way.

Contrary to what was expected, the findings revealed sex differences among the sample. Boys did better than girls on both Drawing Task and Recognition Task. This result is surprising in light of past researches where most of the previous studies have not shown a sex difference. Where these have been found the results have been equivocal. For example, Quiggin (1977) found that girls drew fewer parts than boys, while Gibbons (1985) found the opposite.

Picture 1 - Human Figure Outline



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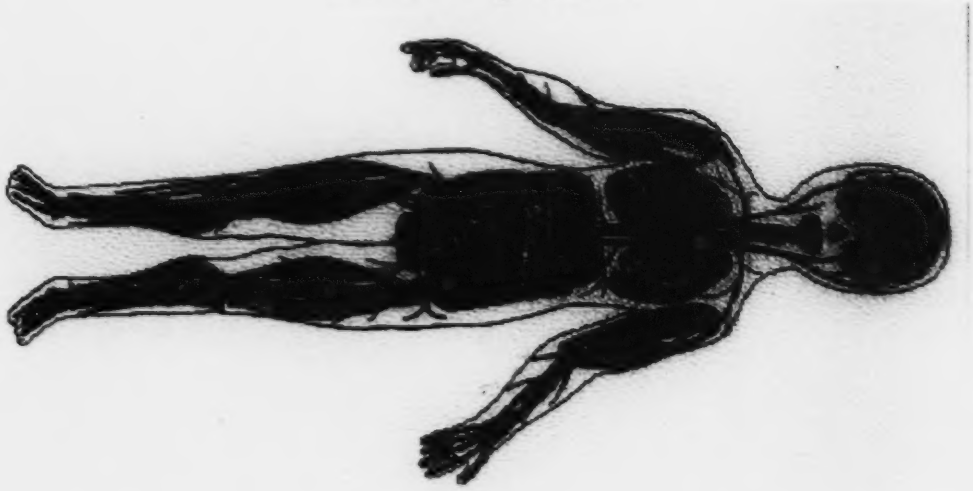
Picture 2 - Right Picture



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Picture 3 - Fancy Picture

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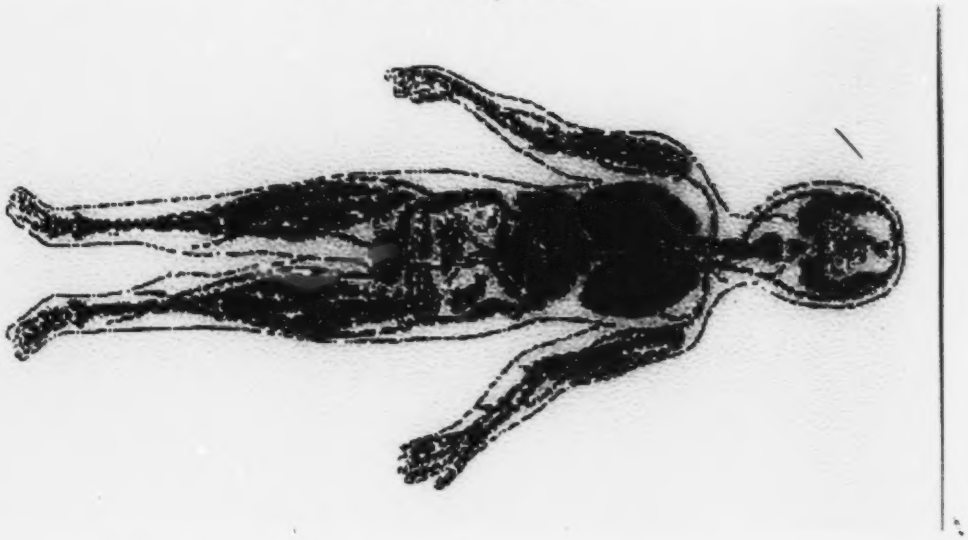

Picture 4 - Wrong Picture

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